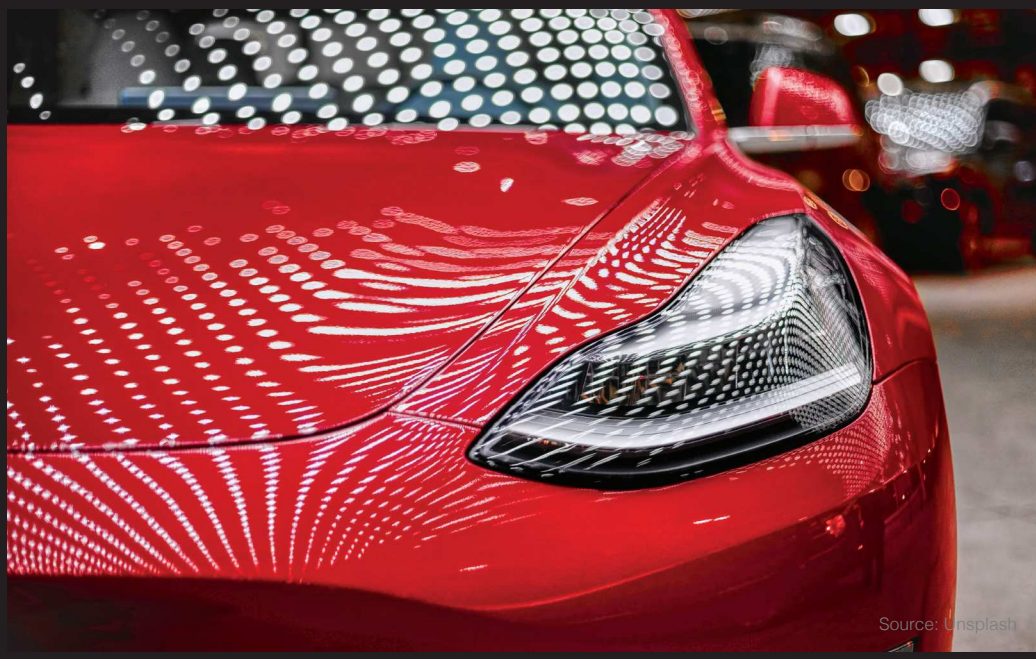
CIO Vantage Point



An Electrifying Future.

Favourable regulations & incentives

13 countries and 31 cities have announced plans to phase out ICEVs and introduce incentives, ranging from cash subsidies to tax exemptions.

Falling production costs

Battery costs have fallen 89% over the past 10 years. We expect EVs to reach cost parity by the end of the decade.

Biggest beneficiaries, automakers

Pure-play EV companies have a strong head start by possessing software and data advantages. Legacy automakers are playing catch-up.

Pick-and-shovel play, charging infrastructure

With an 800% increase in charging stations forecasted by 2025, charging infrastructure providers are the pick-and-shovel play.

DBS

INTRODUCTION

EV

Dear valued clients,

The allure of the Electric Vehicle (EV) has never been stronger. In this second edition of CIO Vantage Point where we highlight transformational themes, we bring to you an in-depth analysis on EVs as they cement their place in the global car industry.

The automobile industry today is undergoing seismic shifts, as the promise of EV mass adoption increasingly becomes a reality. Obstacles that used to stand in the way – high production costs, range anxiety, and limited charging stations – are slowly but surely being conquered.

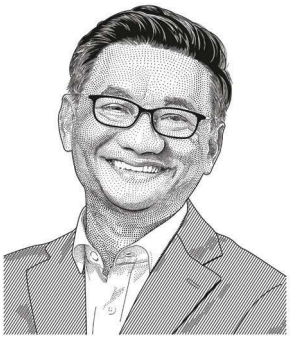
Key players in the space are accelerating EVs as the next generation of rides. EV makers, led by king of the hill, Tesla Inc, are charging ahead with research and development. Governments are supportive of EV adoption, implementing progressive regulation and subsidies to accelerate vehicle decarbonisation. The largest EV markets in the world – China, the US, and Europe – are taking the lead, committing more than a trillion dollars of federal investment over the next decade.

Most significantly, consumer demand for EVs has never been stronger. Despite the pandemic, EV sales grew a whopping 41% to three million units in 2020.

In this report, we also detail four beneficiaries of the EV trend to look out for, and turn the focus to Asia, where market heavyweights China, India, and Indonesia are gearing up to revolutionise their transportation sector.

The car of tomorrow is here, and we invite you to join us as we navigate to an electric future.

I hope you enjoy the read.



Hou Wey Fook, CFA
Chief Investment Officer

An Electrifying Future

Source: Unsplash

EVs
Snapshot

Introduction

Since Tesla kicked off the modern-day EV revolution with the roadster in 2008, the EV market has gradually moved from the fringe to the mainstream. 2020 was a pivotal year as global EV sales grew 40% even though overall car sales fell 14%. Backed by strong policy support, changing consumer attitudes, and falling production costs, the electrification of the transportation sector is set to continue at full throttle.

Listed below are the catalysts and beneficiaries of the electrification trend.

Production Costs

Battery costs have fallen 89% over the past 10 years. We expect EVs to reach cost parity by the end of the decade.

Regulations

13 countries and 31 cities have announced plans to phase out ICEVs. Similarly, major automakers are on track to electrify their product range.

Incentives

In a bid to drive EV adoption, policymakers have aggressively rolled out incentives, ranging from cash subsidies to tax exemptions.

Automakers

Pure-play EV companies have a strong head start by possessing software and data advantages. Legacy automakers are playing catch-up.

Charging Infrastructure

With an 800% increase in charging stations forecasted by 2025, charging infrastructure providers are the pick-and-shovel play.

Battery Manufacturers

With the battery being the most important component of an EV, battery manufacturers are well-positioned to ride the EV boom.

EV: An electrifying future.

Dylan Cheang
Strategist

Rachel Miu
Analyst

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Analyst

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Analyst

A brave new world – transformational shift to electrification. It has been 118 years since Henry Ford introduced the Model A in 1903. Until now, never has the global automobile industry witnessed such transformational change lurking at its doorstep. With advancements in technology and a changing regulatory landscape, Electric Vehicles (EV) are poised to overtake Internal Combustion Engine Vehicles (ICEV) as the automobile of choice in the next century.

There is, however, a sense of déjà vu in this EV vs ICEV rivalry as the very same comparison actually took place more than 100 years ago, long before the days of Elon Musk and Tesla Inc. Back in 1912, American inventor Thomas Edison built three prototype electric cars. Unfortunately, with a price tag double that of normal gasoline-powered vehicles, the first electric cars failed to take off. Sounds familiar?

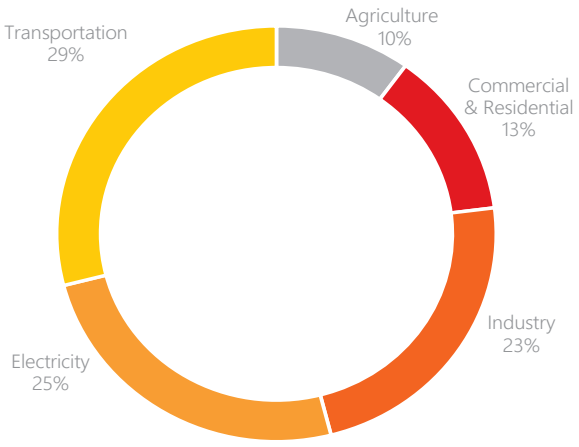
However, the narrative has changed since. Today, technological advancement and rising affordability are paving the way for widespread adoption of EVs. There is also an overarching environmental angle to this argument. Automobiles are the largest contributors to greenhouse gases by far and the transition to EVs would dramatically reduce greenhouse emissions that contribute to climate change.

Catalysts spurring mass adoption of EVs

According to the Environmental Protection Agency (EPA), the Transportation space accounts for the largest share of greenhouse emissions at 29%, followed by Electricity at 25%. As carbon footprint reduction becomes a top global priority, ICEV usage is expected to undergo substantial decline.

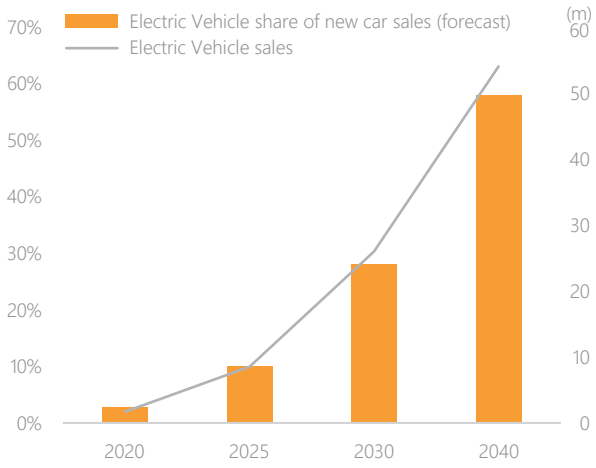
Instead, electrification is slated to be the main driver of vehicle sales in coming years and the outlook is electrifying. According to BloombergNEF, EVs are expected to account for 58% of new car sales by 2040.

Transportation has the largest carbon footprint (2019)



Source: Environmental Protection Agency (EPA), DBS

EV sales on the rise



Source: Bloomberg, NEF, DBS

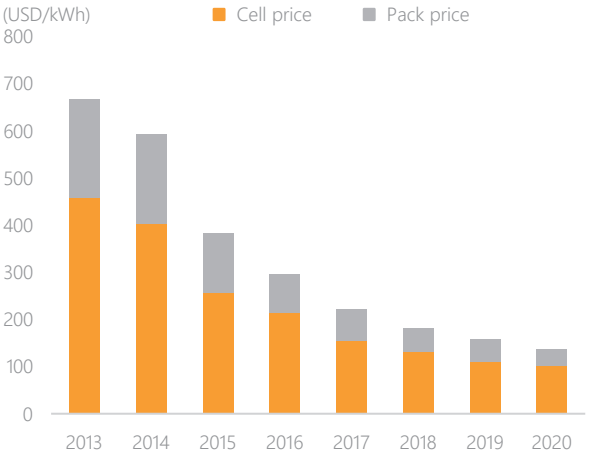
It is hard to start a conversation on EVs without first talking about price. From a consumer perspective, affordability is everything. If the total cost of maintaining an EV is lower than an ICEV in the long run, the shift in the consumption trend will come. Recent developments suggest that the days of affordable EVs are near and the underpinning drivers are: (1) Falling production cost and (2) Progressive government regulations and incentives.

1. Falling Production Cost

The biggest challenge to widespread EV adoption is its higher price point as compared to traditional vehicles. Without subsidies, it is more expensive to buy an EV (USD38,000 – Model 3) vs ICEV (USD25,000 – 2.0L, USD30,000 – 2.5L). On a component basis, the most expensive part of an EV is the battery pack, which accounts for 30-40% of total production cost.

But more players competing in this space means more capital investment. The surge in research and development (R&D) dollars brought about new battery chemistry and manufacturing techniques which resulted in higher rising battery density (4-5% a year) and faster charging speeds. This translated to a sharp decline in production cost for EV batteries over the past decade, from USD1,160/kWh in 2010 to USD137/kWh in 2020.

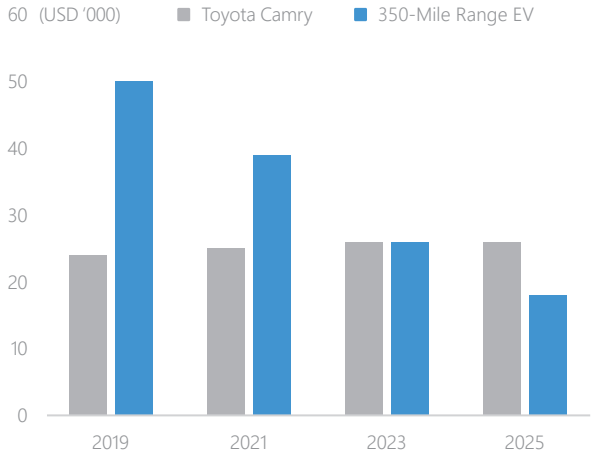
EV battery production cost



Source: Bloomberg DBS

At which point would EVs undergo mass adoption? The simple answer is: EVs will see widespread adoption when its production cost is on par with ICEVs.

EVs approaching sticker price parity with ICEVs



Source: Ark Invest, DBS

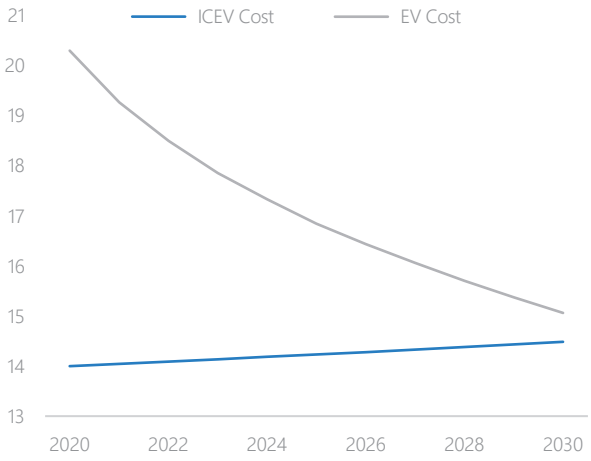
To further analyse this, we constructed an industry model forecasting the future production cost curves for both ICEVs and EVs. According to the Institute of Automotive Technology (Technical University of Munich), the breakdown of EV production by components is: (1) Battery: 39%, (2) Interior: 13%, (3) E-Drive: 10%, (4) Exterior: 10%, (5) Assembly: 7%, (6) Chassis: 6%, (7) Powertrain: 3%, and (8) Others: 10%.

In our forecast, we project EV battery cost to decline 8-12% per annum from now till 2025, before moving to a more consistent level of 7% until 2030. The other components, such as E-Drive and Powertrain, are expected to undergo smaller cost declines of 1.0-1.5% per annum. The engine cost for ICEV, on the other hand, is expected to increase by a gradual 1.5% per annum.

Based on our analysis, EV production cost is expected to decline 26% from EUR20,300 currently to EUR15,100 by 2030. This is predominantly due to a 58% decline in battery cost as a result of growing economies of scale and higher R&D investments. To be sure, our forecast is skewed to the conservative side as it has yet to factor in the positive impact from solid-state batteries, which is targeted for launch in 2024.

The production cost for ICEV, meanwhile, is slated to increase by 3%, reaching EUR14,500 by 2030. Under this pricing assumption, the discount between ICEVs and EVs will narrow from EUR6,300 currently to EUR600 by 2030 – a reduction of 91%. We believe that the mass adoption of EV will take place at that juncture.

EV expected to reach cost parity by c.2030

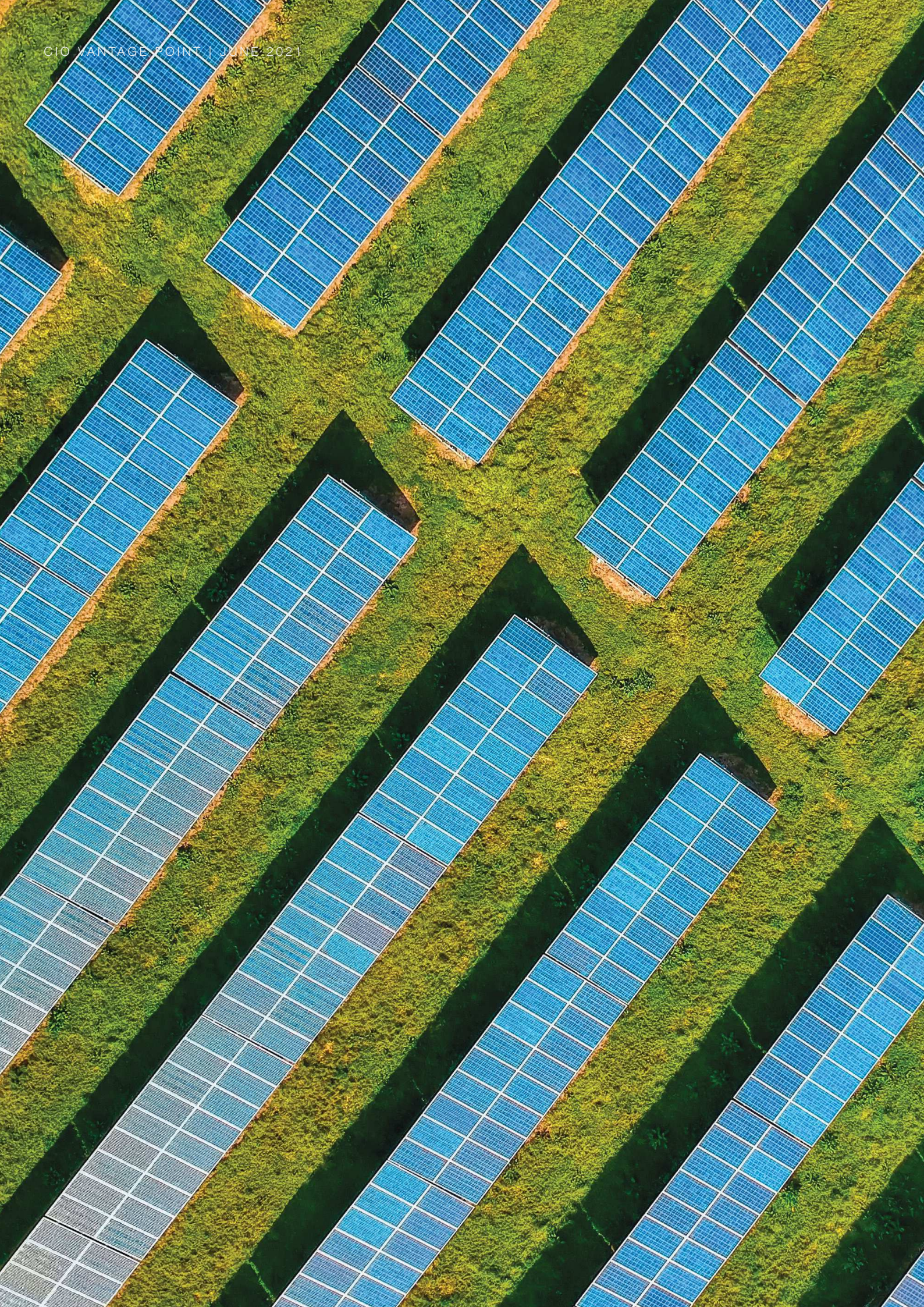


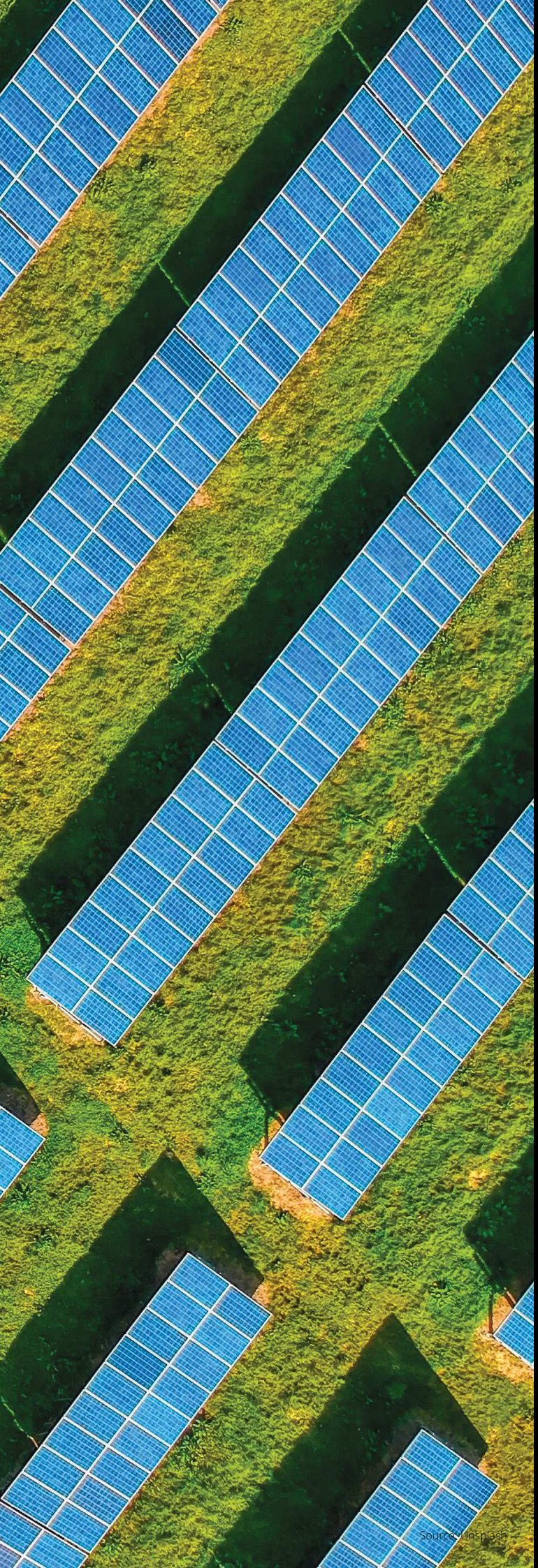
Source: Institute of Automotive Technology (TU of Munich), DBS

Forecasts for ICEV and EV production cost

(IN EUR '000)	2020	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E	% CHG. (2020 VS 2030E)
ICEV cost	14	14	14.1	14.1	14.2	14.2	14.3	14.3	14.4	14.4	14.5	3%
Engine	3	3	3.1	3.1	3.2	3.2	3.3	3.3	3.4	3.4	3.5	16%
E-drive	0	0	0	0	0	0	0	0	0	0	0	-
Powertrain	2	2	2	2	2	2	2	2	2	2	2	0%
Interior	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	0%
Exterior	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	0%
Chassis	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0%
Assembly	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	0%
Others	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	0%
EV cost	20.3	19.3	18.5	17.9	17.3	16.8	16.4	16.1	15.7	15.4	15.1	-26%
Battery	8	7	6.3	5.8	5.3	4.9	4.5	4.2	3.9	3.7	3.4	-58%
E-drive	2	2	2	1.9	1.9	1.9	1.9	1.9	1.8	1.8	1.8	-10%
Powertrain	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	-14%
Interior	2.7	2.7	2.8	2.8	2.8	2.8	2.9	2.9	2.9	3	3	10%
Exterior	2.1	2.1	2	2	2	1.9	1.9	1.9	1.9	1.8	1.8	-14%
Chassis	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	-10%
Assembly	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	-14%
Others	2	2	2	2	2	2	2	2	2	2	2	0%
Cost Gap	-6.3	-5.2	-4.4	-3.7	-3.1	-2.6	-2.2	-1.7	-1.3	-0.9	-0.6	

Source: Institute of Automotive Technology (TU of Munich), DBS





Source: Unsplash

13 countries and 31 cities announced plans to phase out ICEVs

From a consumer's "total affordability" perspective, vehicle price is only one part of the equation. The cost of usage/maintenance after the purchase is equally important. One component that is closely watched is energy efficiency, which EVs clearly possess a significant advantage over ICEVs.

The most efficient ICEVs in the market have an energy efficiency of 16-25%. EVs, on the other hand, transfer 86-90% of the power to wheels. According to the United States Environmental Protection Agency, one of the most efficient ICEVs is the Toyota Camry at 32mpg (miles per gallon) while the Tesla Model 3 Standard Range Plus does 141mpg.

EVs' advantage in energy efficiency explains why it is not only better for environmental reasons, but for commercial reasons as well.

More efficient in converting energy to power

	ICEV Efficiency	EV Efficiency
Charging losses	68% to 72%	10%
Drivetrain losses	5% to 6%	20%
Other losses	12% to 17%	8%
Regenerative braking	-	+17%
Power to the wheels	16% to 25%	86% to 90%

Source: Cleanerwatt, DBS

2. Progressive Government Regulations & Subsidies

Vehicle decarbonisation requires long-term commitment from all parties – from governments to automobile companies and consumers. Transportation is responsible for about 24% of direct CO2 emissions from fuel combustion, out of which, road vehicles account for nearly three quarters. Growing pressure to reduce vehicle CO2 emissions is the primary factor for automobile manufacturers to accelerate their vehicle electrification plans.

The government plays an important role in driving EV adoption, through a mixture of regulations and subsidies. The pace of vehicle decarbonisation is expected to accelerate globally, with the US trying to catch up with Europe and Asia.

- Government Regulations: In 2015, 196 countries signed the Paris agreement, a legally binding international treaty on climate change to limit global warming to below 2 degrees Celsius. Under this agreement, countries are required to submit long-term strategies on how they can reduce their greenhouse gas emissions.

  Since then, policymakers in 13 countries and 31 cities/regions have announced plans to phase out the sale of ICEVs while the biggest economies have also proposed legislation or passed laws to achieve net-zero emission.

Progression towards net-zero emissions

Country/ Region	Year	Target
Suriname	-	Achieved
Bhutan	-	Achieved
Sweden	2045	In law
United Kingdom	2050	In law
France	2050	In law
Denmark	2050	In law
New Zealand	2050	In law
Hungary	2050	In law
European Union	2050	Proposed legislation
Canada	2050	Proposed legislation
South Korea	2050	Proposed legislation
Spain	2050	Proposed legislation
Chile	2050	Proposed legislation
Fiji	2050	Proposed legislation

Source: Energy & Climate Intelligence Unit Net Zero Tracker, DBS

Listed below are some of the key regulations enacted in major EV markets – the US, Europe, and China:

Regulations undertaken by the US, Europe, and China

Country	Regulations
US	In the US, President Biden recognises climate change as an existential threat and has committed the US to reaching net-zero emissions by 2050. The president's climate and environmental justice proposal will make USD1.7t of federal investment over ten years towards clean energy.
Europe	The European Union member states are expected to achieve net-zero emissions by 2050. The European Commission also launched a stimulus package recently with up to EUR550b earmarked to be spent on climate change from 2021-2027.
China	In China, President Xi announced that its emissions would peak before 2030 and China will work towards being carbon neutral by 2060. There are also mandates imposed on car manufacturers, requiring them to sell a certain number of EVs each year to avoid financial penalties. This requirement will go up every year until EV sales constitute 40% of total car sales.

Source: US Department of Energy, Europa, MIT

Accelerating towards the future

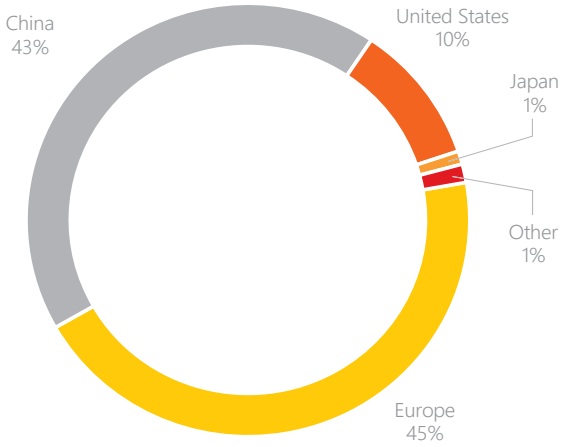
Source: Unsplash

- Government incentives: Although the environmental benefits of EVs are widely publicised, consumers remain resistant to innovations that may disrupt their established habits and routines. Hence, apart from implementing regulations, governments are also dishing out incentives to drive consumer adoption of EVs.

  In the past decade, policymakers have implemented supportive incentives like cash subsidies, rebates, and tax exemptions to drive EV sales. According to market surveys by the Institute of Transportation Studies, nearly 30% of US consumers who bought EVs cited EV credits as an important factor in their purchase decisions.

  Listed below are some of the key incentives available in major EV markets like the US, Europe, and China.

Worldwide Electric and Plug-in Hybrid sales (2020)



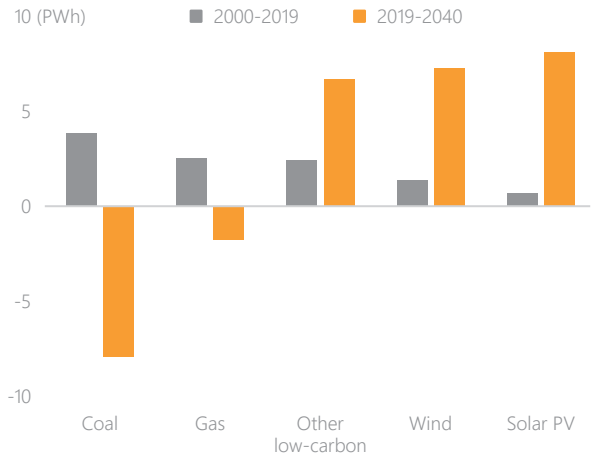
Source: Bloomberg, DBS

EV incentives in the US, Europe, and China

Country	Regulations
US	The US has the third-largest EV market in the world with 1.1m EVs in active use. On the federal level, new EVs enjoy a federal income tax credit of up to USD7,500 on top of state and local incentives. In most cases, the combined incentives would be over USD10,000 in savings. The government has recently stipulated that the federal government's fleet of ICEVs will be replaced with US-made EVs. Additionally, there are also plans to provide more incentives for consumers to replace ICEVs with EVs.
Europe	Europe has the second-largest EV market in the world with 1.2m EVs in active usage. The automotive industry is crucial for the EU as it employs 6.1% of the workforce and generates over 7% of its GDP. Germany, for instance, offers lower VAT and cash subsidies (up to EUR9,000 for EVs that cost below EUR40,000) for EVs. All EU member countries (excluding Lithuania) plus the United Kingdom offer incentives and/ or tax reductions for purchase of EVs.
China	China, the largest EV market in the world with 2.3m EVs in active usage (45% global stock of EVs), sees an opportunity, with the mass adoption of EVs, to become a major automobile exporter. China has extended incentives for purchase of New Energy Vehicles (NEV) by providing exemptions from vehicle purchase tax and cash subsidies for NEV passenger cars that cost less than CNY300,000. In cities like Beijing, only EVs are allowed in the city centre. In Shanghai, EVs are exempted from the astronomical license plate fees which on average costs CNY89,000.

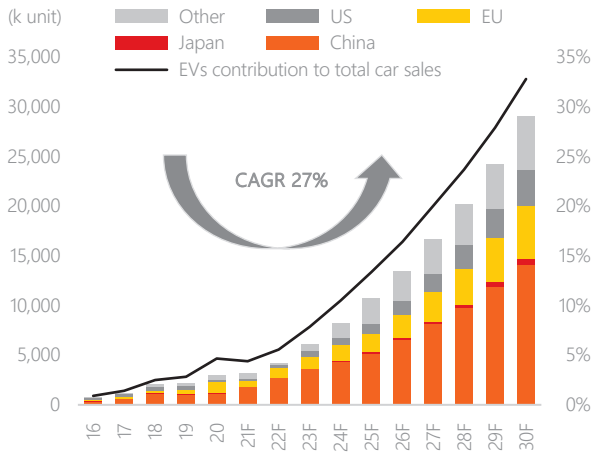
Source: Virta, U.S. News, Europa, Argus Media, Bloomberg

Change in global electricity generation



Source: Bloomberg, DBS

Passenger EV (BEV & PHEV) sales forecasts



Source: IEA, DBS

Outlook for EV sales

Despite the Covid-19 pandemic and decline in global total car sales, EV sales have grown strongly – increasing 41% y/y to c.3m units in 2020 – driving EV contribution to total car sales to a record 4.6% during the year. The robust momentum was underpinned by:

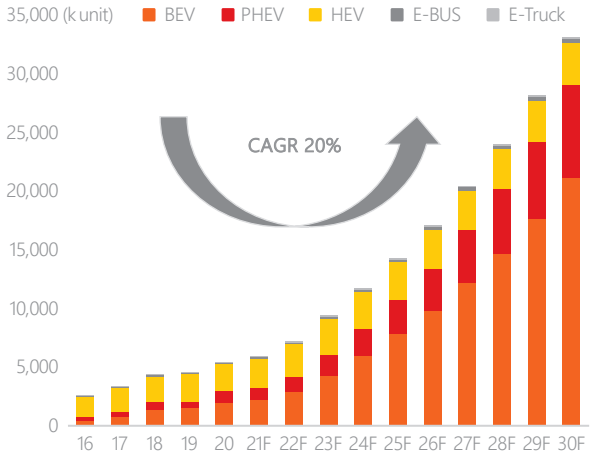
1. Strong policy support and additional stimulus measures, particularly in Europe; 2020 was an important target year for emissions standards while purchase incentives also increased (notably in Germany)
2. Continued declines in battery costs and OEM's upgraded offers in both model choice and performance in EV

Given the positive outlook for the sector, we expect total EV sales to register CAGR of 27% between 2020 and 2030. On a geographical basis, the bulk of the new EV demand will come from China. In 2020, China accounted for 39% of total EV sales and by 2030, this is expected to increase to 49%, with Europe and the US accounting for 18% and 12%, respectively.

In terms of vehicle type, there are three main categories of EVs currently in the market: (1) Battery Electric Vehicles (BEVs), (2) Plug-in Hybrid Electric Vehicles (PHEVs), and (3) Hybrid Electric Vehicles (HEVs). BEVs are full EVs that run on battery power only while PHEVs and HEVS both have a small gasoline engine that helps extend range.

Currently, HEVs account for 42% of the market while BEVs account for 37%. But by 2030, the market for BEVs is expected to surge to 64%, with PHEVs and HEVs accounting for 24% and 11%, respectively.

EV sales forecasts (by vehicle type)



Source: IEA, DBS

Beneficiaries of the electrification trend

The EV sector is expected to undergo phenomenal growth in the coming years as the EV overtakes the ICEV as the vehicle of choice for global consumers. On a segmental basis, the biggest beneficiaries of this wave are: (1) Automakers, (2) EV Charging Infrastructure Providers, and (3) Raw Material Providers.

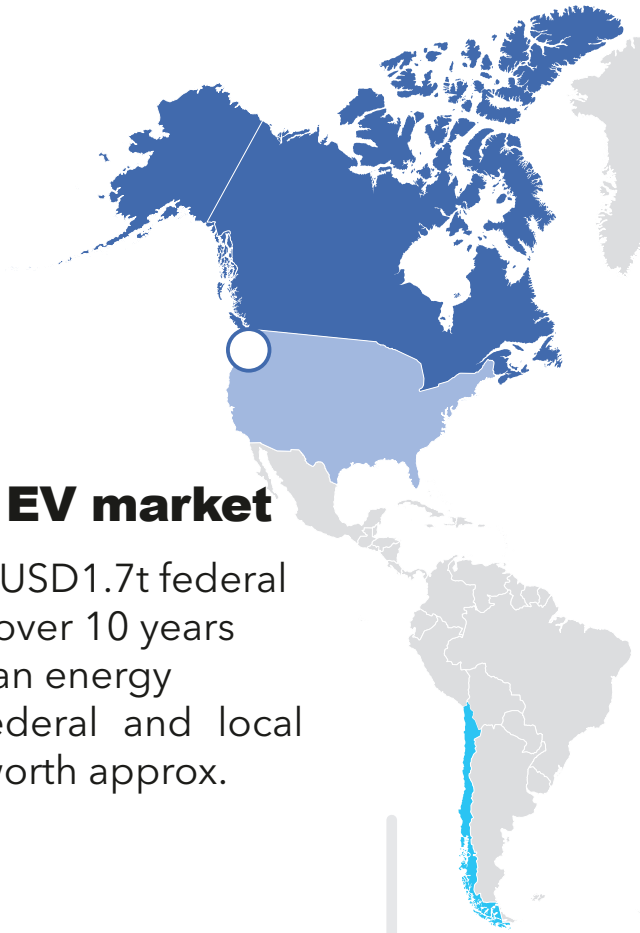
1. Automakers

The most direct beneficiaries of rising EV sales are the automakers. But not all automakers are created equal. In this section, we look at how pure-play EV companies stack up against automotive incumbents.

i. **Pure-play EV Companies – unencumbered by legacy technology.** Companies like Tesla are unencumbered by legacy technology. This allows them to develop EVs without the fear of cannibalising their existing ICEV product range or rendering their existing production lines redundant.

   EVs from these companies are developed like smart phones. They receive regular over-the-air software updates which enhance vehicle performance, introduce new features, and provide security updates. This not only helps to improve customer satisfaction; more importantly, it helps to extend the product lifecycle.

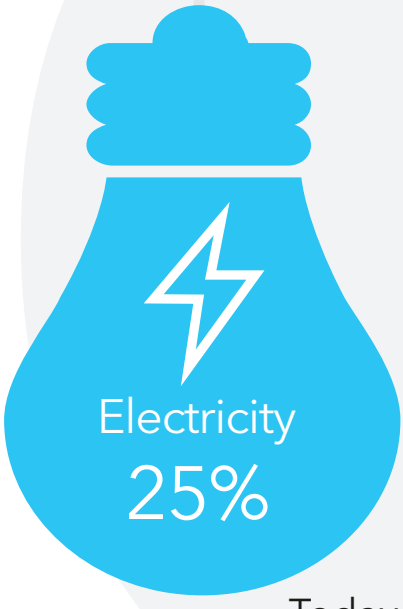
EV. the future is electric.

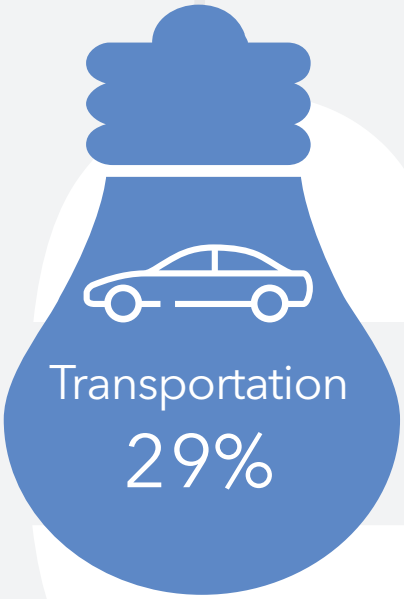


US

3rd largest EV market

- Committed USD1.7t federal investment over 10 years towards clean energy
- Provides Federal and local incentives worth approx. USD10,000





Today, the Transportation & Ene
account for more than half the G
Gas emissions in the US.
But this is set to change.

China

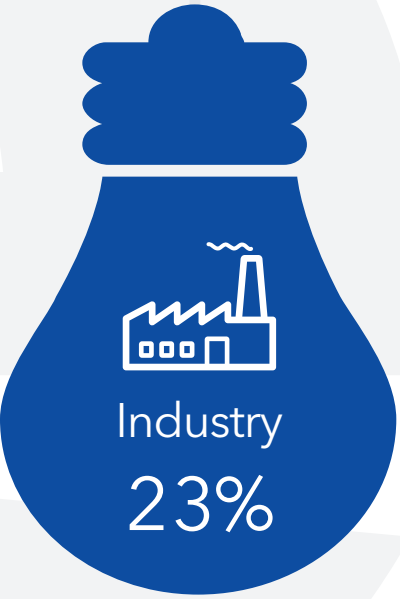
Largest EV market

- Government imposes mandates on automakers to sell a certain number of EVs
- EVs are exempted from vehicle purchase tax and receive cash subsidies if it costs less than CNY300,000

Europe

2nd largest EV market

- European Commission launched a stimulus package with up to EUR550b earmarked for climate change
- Offers lower taxes and cash subsidies for EV purchases



rgy sectors
Greenhouse

EVs are set to account for 58% of New Car sales by 2040, up from only 2.7% in 2020

The other key advantages of pure-play EV companies are:

» Data goldmine: EVs are equipped with multiple cameras, radars, and ultrasonic sensors that constantly gather data back to their manufacturers. According to Intel, autonomous vehicles produce up to 4TB of data a day. This feature gives companies like Tesla an enormous advantage over its competitors as the company has already collected 3b autopilot miles (as of February 2020).

  In an era where more training data translates to better performance, Tesla's data advantage will prove to be significant when companies start rolling out autonomous driving services.

» Recurring revenue: Vehicles built by pure-play EV companies are among the most technologically advanced in the world and they adopt a "recurring revenue" business model through the provision of software subscription services for their users, for instance:

  - Tesla indicates that it will launch a "Full Self-Driving Package" on subscription basis, coming on the back of the "Premium Connectivity" subscription plan launched at USD9.99 prior. This plan offers users live traffic visualisation, in-car streaming music/media, and Internet browsing.
  - Chinese EV maker, NIO, on the other hand, has a battery swap programme that allows users to swap for fully -charged batteries up to six times a month for USD142.

The shift towards "recurring revenue" business models, with SaaS (Software as a Service) or BaaS (Battery as a Service), allows automakers to pivot away from low margin hardware production to the highly lucrative service models.

ii. Legacy Automakers – playing catch-up. Given the astronomical growth of EV start-ups and stricter emissions targets, legacy automakers are frantically playing catch-up by announcing major overhauls to their business models and adapting to the "new normal" of rising electrification in the automotive industry. For instance:

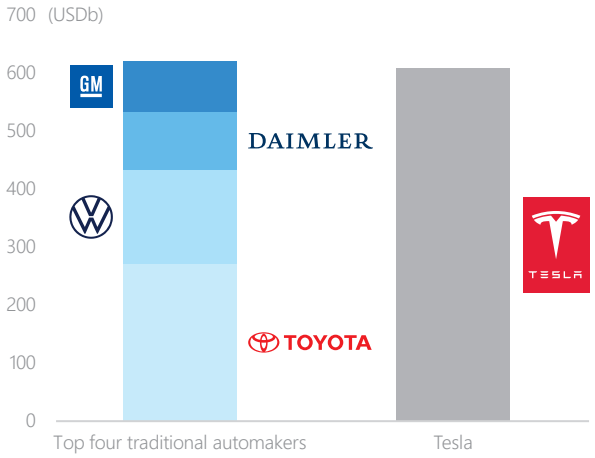
» Volkswagen (the biggest automotive group in Europe which owns brands such as Audi, Bugatti, Porsche, Lamborghini, Skoda, and SEAT) will be investing c.USD85b over the next five years on e-mobility and digital technologies. By 2029, Volkswagen plans to have 75 full electric and 50 hybrid models for sale.

» Ford plans to spend USD30b on vehicle electrification by 2025, targeting 40% of future sales to be electric by 2030. Its domestic rival, General Motors (GM),

is also planning to spend USD27b on electric/autonomous vehicles by 2025, and a more aggressive target of selling only EVs by 2035. GM also plans to be a carbon neutral company by 2040.

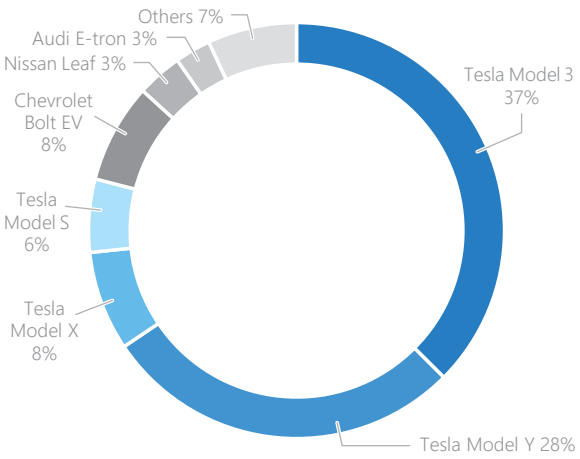
» Fiat-Chrysler recently merged with PSA Group (Peugeot) to form Stellantis. This merger will allow the group to share synergies across its 14 brands and spread development cost across more vehicles. BloombergNEF predicts that 500 different EV models will be available globally by 2022.

Tesla is worth as much as the top four traditional automakers combined



Source: Bloomberg, DBS

Tesla accounted for nearly 80% of US EV registrations (2020)



Source: electrek, DBS

2. EV Charging Infrastructure Providers

For years, it has been a chicken and egg problem for the EV charging infrastructure space:

» On one hand, range anxiety and the availability of charging stations are among the key reasons behind consumers' reluctance to consider an EV. A study conducted by Cox Automotive found that 83% of consumers cited battery life and charging anxiety as a leading barrier to EV adoption.

» On the other hand, automakers are unwilling to allocate capital for the construction of expensive charging stations until existing demand justifies doing so.

However, there is Tesla. Tesla bucked the industry trend by forging ahead and building thousands of superchargers. This move gave the company the first-mover advantage as the extensive network of chargers provided Tesla vehicle owners with flexibility and convenience. Today, Tesla owns/operates more than 2,700 stations housing over 20,000 superchargers, the largest fast charging network globally.

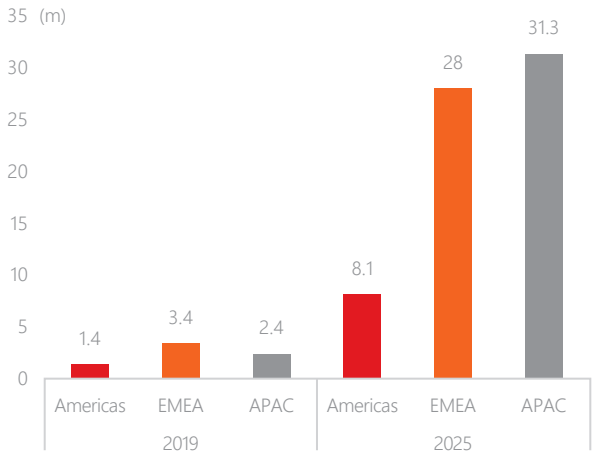
In a bid to play catch-up, the other automakers started partnering with existing charging networks (instead of building their own):

» Shell announced plans to build 500,000 electric charging stations in the next four years while BP would be partnering with Chinese firm DiDi to develop a fast charging station network across China.

» GM partners with EVgo, the largest public EV fast charging network to build 2700 new fast chargers in the US.

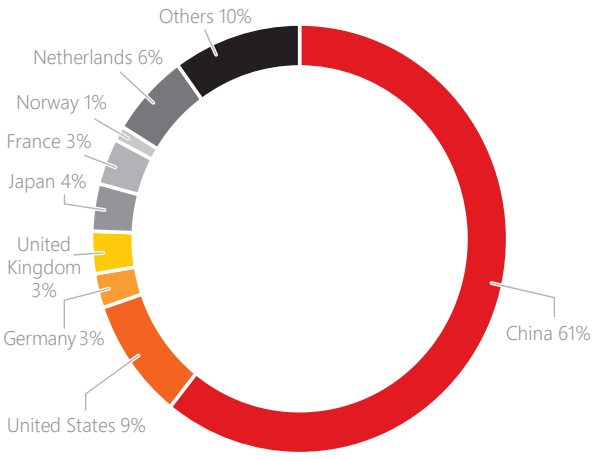
According to IHS Markit, an 800% increase in the number of charging stations globally is expected by 2025, with the highest growth coming from Asia Pacific. Research firm Market Study Report expects the global EV charging infrastructure market to increase from USD11.3b in 2019 to USD113.2b by 2027 (CAGR of 33.4%).

No of charging stations globally



Source: IHS Markit, DBS

No. of publicly accessible electric chargers (2019)



Source: IEA, DBS

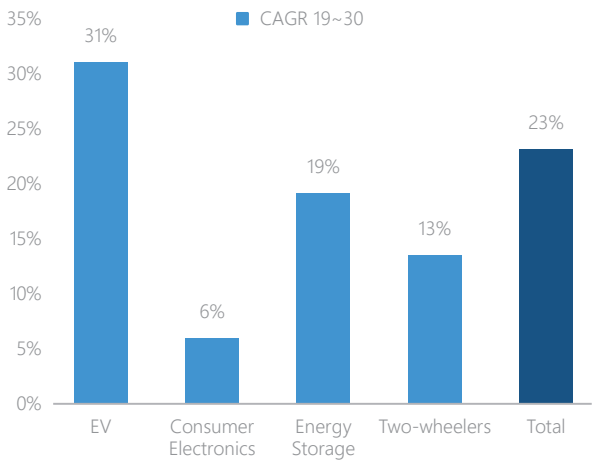
Source: Unsplash

3. Battery Manufacturers

Given the importance of batteries in EVs, naturally, another geared beneficiary of the electrification trend would be the battery manufacturers. According to IEA, automotive lithium-ion (Li-Ion) battery production increased 33% y/y to 160GWh in 2020 amid a 41% increase in electric car registrations. In future, we expect EV battery production to register stronger growth than EVs.

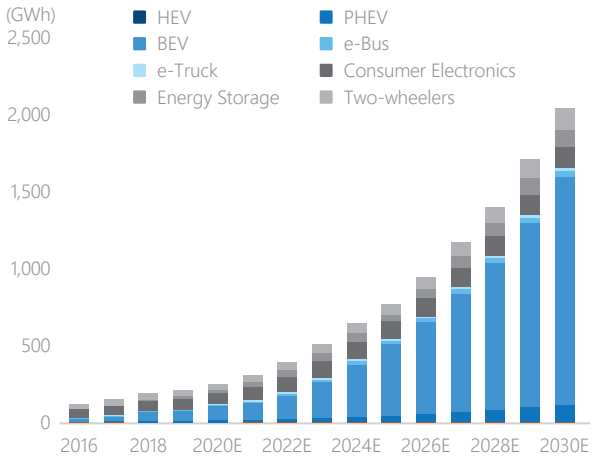
Based on our forecast, EV battery demand is expected to register CAGR of 31% by 2030 as a result of rising battery capacity installation per car and energy density of batteries. Geographically, the key drivers of global battery demand are depicted in the charts that follow.

Battery demand growth by sector (2019-2030)



Source: IEA, DBS

Battery demand forecasts (by vehicle)



Source: IEA, DBS

» China: China accounts for over 70% of global battery cell production capacity and contributes to 50% of global battery demand at c.80GWh in 2020.

» Europe: Europe registered the largest battery demand growth of 110% to reach 52GWh in 2020, exceeding domestic production capacity of c.35GWh. The EU has announced an ambitious plan to install EV battery capacity up to 400GWh by 2025.

Currently, the major EV battery manufactures are CATL, LG Energy Solution, and Panasonic and their respective market shares in 1Q21 are 32%, 21%, and 17%.

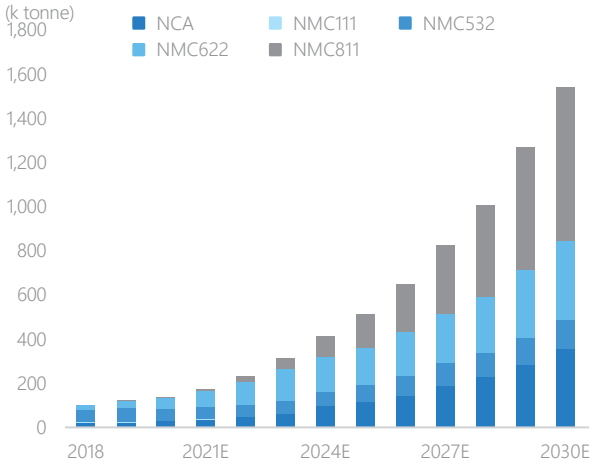
4. Battery Materials Producers

Riding on the strong demand for EV batteries, the battery materials producers are also expected to see strong growth in the coming decade. The focus in the industry these days is on "energy density", which is a measure of how much energy a battery contains in proportion to its weight (Wh/kg). Higher energy density enables EVs to increase their driving distance and this is attained by increasing nickel content in the cathode chemistry.

In 2020, nickel-manganese-cobalt (NMC) continued to be the dominant chemistry for Li-ion batteries with around 71% market share while nickel-cobalt-aluminium accounted for the bulk of the remaining. While lithium-iron-phosphate (LFP) battery chemistry had regained some market share, it still accounted for less than 4% of the market.

The strong global demand for battery materials such as lithium, nickel, and cobalt has led to respective price surges of 142%, 34%, and 53% since Jul 2020. We expect nickel demand from EV batteries to account for 35% of total nickel demand in 2030 (up from 5% in 2020), as a result of 31% annual growth in EV battery demand.

Nickel demand (by cathode chemistry)



Source: WBMS, IEA, INSG, DBS

Lithium vs Cobalt prices

Source: Bloomberg, DBS

Challenges facing the EV industry

Previously, the biggest challenge to widespread EV adoption was battery cost. But thanks to technological progress in battery chemistry and rising productivity, battery cost has fallen steadily over the years and it is no longer an impediment to EV usage. Instead, the two key challenges weighing on EV growth are: (a) Shortage of automotive chips and (b) Shortage of EV charging infrastructure.

» Shortage of automotive chips: The tight supply of automotive chips is affecting the global value chain, hitting both EV and ICEV production. The impact appears to be uneven, with North America and Europe taking a bigger hit than Asia. To circumvent these headwinds, global automakers are aligning their production and focusing on high-margin models to meet rising demand from China.

  But due to the complexity and advanced technology of EVs, automotive chip content value is estimated at three times higher than conventional vehicles. The market expects automotive chip supply to take 1-2 years to normalise.

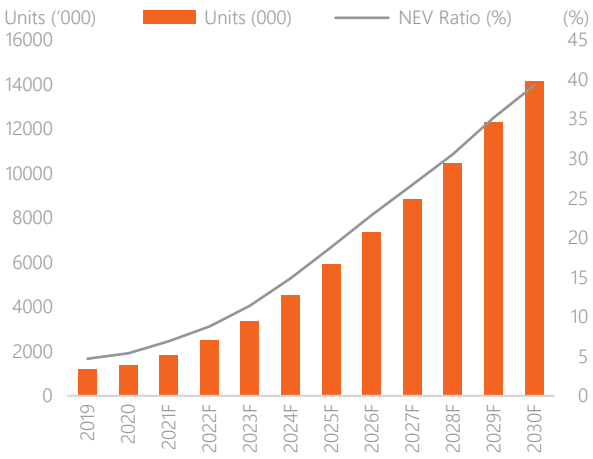
» Shortage of EV charging infrastructure: A shortage of EV charging infrastructure could also be a drag on EV adoption worldwide. In this instance, China appears to have a better EV charging rollout programme, with approximately 1.76m charging points at the end of February 2021, supporting about three EVs per charging point.

Asian Focus I: China

China has led the world in vehicle electrification for a decade with the government recently announcing a long-term development plan (2021-2035) as part of the initiative to steer the country to carbon neutrality by 2060. The plan draws on the support of the energy and communications sectors to speed up EV market expansion, with the aim of achieving c.20% of NEV sales ratio to total passenger cars by 2025, up from c.6% in 2020.

To encourage EV technological advancement and lower reliance on subsidies, the government has raised the requirements on driving range and battery efficiency in order to qualify for NEV subsidies. At the same time, the Chinese government has reduced its NEV subsidy by 20% this year and the scheme will expire by end-2022.

China NEV sales projections



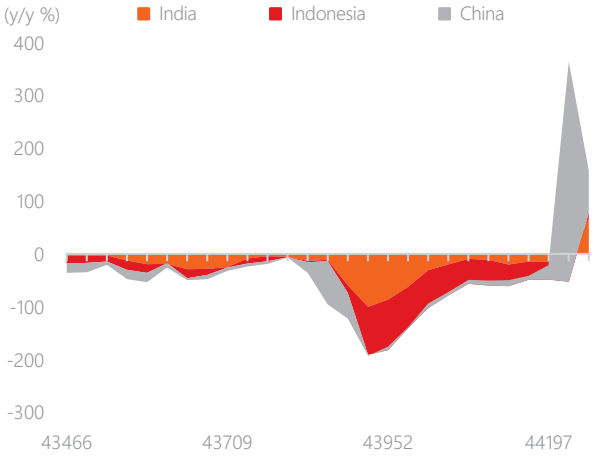
Source: CEIC, DBS

Liberalisation of the Chinese NEV market in 2018 paved the way for rapid industry development. A strong eco-system has helped China excel in the EV space. The Shanghai Auto Show held in April 2021 demonstrated China's ability to attract global players, with over 50 new EV models and concept cars being featured during the show.

Above all, a new group of domestic EV makers such as NIO, XPeng, and Li Auto has emerged in China, injecting more vibrancy into the EV market. Collaborations between ICE automakers and Technology giants (such as Tencent, Baidu, and Huawei) further enhance China's EV development, especially in the smart EV space.

We estimate the Chinese NEV market to grow at an annual rate of c.30% to c.6m units by 2025 and by 2030, NEV penetration is expected to hit c.40%.

Domestic passenger and commercial vehicle market growth



Source: CEIC, DBS

Asian Focus II: India and Indonesia

EV development in India and Indonesia are still in their early stages as these markets are largely dominated by the 2- and 3-wheelers. Besides, the charging infrastructure network is underdeveloped to promote EV adoption.

» India EV industry: From April-March 2021, India achieved domestic sales of c.2.8m units of passenger vehicles and c.0.7m units of commercial vehicles. India will stick to the Paris pledge to reduce its carbon footprint by 33-35% from its 2005 levels by 2030 and is studying the possibility of achieving carbon neutrality by 2050.

That said, EVs make up a very small portion (less than 1%) of the overall market. Overcoming range anxiety is the key to increasing EV adoption in India.

» Indonesia EV industry: Indonesia's government has proposed to nurture the EV market, but progress remains slow. So far, Indonesia's participation is largely as a supplier of key battery materials like nickel. In 2019, the Indonesian government set an ambitious target of 20% of vehicle production to comprise electric and hybrid vehicles by 2025, including 20% of the targeted 1m vehicle exports.

The EV regulations stipulate minimum local content levels of 80% by 2029, and the government is leveraging on the abundant resources (such as cobalt, zinc, and nickel) to attract EV and battery investments into the country.

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Company	Ticker
Baidu Inc	BIDU US
BP PLC	BP US
Daimler AG	DAI GR
DiDi Global	DIDI US
Ford Motor	F US
General Motors	GM US
Intel Inc	INTC US
Li Auto	LI US
NIO Inc	NIO US
Nissan Motor	7201 JP
Panasonic Corp	6752 JP
SAIC Motor	600104 CH
Stellantis NV	STLA IM
Tencent Holdings	700 HK
Tesla Inc	TSLA US
Toyota Motor	7203 JP
Volkswagen AG	VOW GR
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